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THE PASTURAGE SYSTEM FOR HANDLING RANGE SHEEP.

INVESTIGATIONS DURING 1909.

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CONTENTS.

	Page.
Introduction	5
Repairing the fence	6
Efficiency of the fence against predatory animals	6
Plan of observation	7
Method of observation	7
The hounds	7
The trail	7
Attitude of animals toward the fence	8
Coyotes	8
Bears	9
Bobcats	9
Lynxes	9
Badgers	9
Actions of ewes and lambs at liberty in the inclosure	10
Observations made	10
Discussion	17
Separating into small bunches	17
Open grazing	19
Rambling about	20
Bedding	20
Number of sheep one man can care for in pasture	21
Effects of the pasturage system upon the sheep and the carrying capacity of the range	22
The sheep	22
Comparative loss	23
Weights at close of season	24
Wool growth	26
Cost of handling	27
Carrying capacity of the range	27
Summary	28
Reasons for improved condition of sheep and increased carrying capacity of the range	29
Increase in weight	29
Increase in carrying capacity	30
Suggestions for handling sheep under the herding system	32
The pasturage system for lambing ewes	32
Lambing on the open range	33
The broadcast system	33
The corral system	34
Pasture lambing	36
Comparative discussion of the systems	38
Loss	38
Carrying capacity of the range	39
Cost of handling	39
Possible use of inclosures in connection with lambing allotments	40

ILLUSTRATIONS.

		Page.
PLATE I.	Coyote-proof fence and hunter with hounds patrolling it	9
II.	Area supporting dense growth of flowering plants and small clover	17
III.	Pastured band at the close of the season	25
IV.	View showing improvement of forage crop due to moderate sheep bedding	33

THE PASTURAGE SYSTEM FOR HANDLING RANGE SHEEP.

INTRODUCTION.

This report contains the results of experimental work during 1909 to determine the efficiency of the pasturage system of handling sheep, with a view to the best utilization of grazing lands. The studies, for the most part, were conducted in the coyote-proof pasture at Billy Meadows, in the Wallowa National Forest, Oregon. In addition, observations to determine the feasibility of the pasturage system for lambing ewes were made on the lambing grounds on open range as well as in pasture.

The coyote-proof pasture comprises 2,560 acres in the form of a square, 2 miles on a side, made up of 1,300 acres of heavy timber, 400 acres of open timber, and 860 acres of untimbered scab land and meadows.

The investigations during 1909 were a continuation, with some slight changes, of experimental work planned and initiated in 1907 by the Forest Service in cooperation with the Bureau of Plant Industry. A preliminary report of the progress made during 1907 was published as Circular 156 of the Forest Service. Circular 160 of the Forest Service carried the experiments through 1908. For details of the coyote-proof fence and its construction the reader is referred to Circular 156, and for the experimental results obtained prior to 1909 to Circular 160.

The present circular, which carries the work through 1909, will discuss the durability of the coyote-proof fence and the cost of maintaining it; the efficiency of the fence as a protection against predatory animals, especially coyotes; the actions of a band of Merino ewes with lambs sired by Shropshire rams when unmolested in pasture; the effect of such a system of grazing upon the sheep and upon the carrying capacity of the range; the factors that bring about the increase in weight of the sheep and the increase in the carrying capacity of the range; and a supplementary comparative discussion of lambing ewes under the prevalent methods of the herding system and lambing them in pasture.

REPAIRING THE FENCE.

The cost of keeping a coyote-proof fence in proper repair will depend upon the thoroughness of construction and the locality in which it is built. Unless the construction work is well done in every detail there will be a constant need for repair of loose and broken wires and holes under the fence. On the other hand, a fence constructed with proper care on an untimbered area will require little attention, and the cost of maintenance during the first few years will be almost negligible. In a heavily timbered area the damage done will vary with the intensity of snow and wind storms. Great loads of wet snow may throw a few trees; accompanied by heavy wind they may throw a good many. Wind alone will do little damage except during the rainy season, when the ground is saturated to a considerable depth and shallow-rooted trees overturn easily.

In 1908 thirty-eight trees fell across the wires along the 5 miles of the coyote-proof pasture fence that runs through a heavy lodgepole and yellow pine forest. They were removed and the fence was repaired at a cost of $10. An additional $10 was expended in repairing holes made by the spring run-off and by badgers. During 1909 only ten trees fell across the fence. They were removed and the fence repaired by one man in one and one-half days, at a cost of $3.75. Badgers had dug under the wire during the fall and early spring in fifteen places. This damage was repaired by driving stakes into the holes and then filling in with dirt. Stakes placed close together will discourage coyotes from attempting to scratch out the loose dirt and crawl through. The entire work of removing trees and filling holes required only two days' labor for one man, at a cost of $5.

When the experiment was closed, on October 1, 1909, the fence was in excellent condition.

The cost of maintenance of the 8 miles for the first year, 1908, was $20; for the second year, 1909, $5.

EFFICIENCY OF THE FENCE AGAINST PREDATORY ANIMALS.

To enable the reader to recall the details of the experimental coyote-proof fence at Billy Meadows, the specifications are repeated:

Posts set 2½ feet in the ground and 16 feet apart; on the surface of the ground a barbed wire; 3 inches higher a 42-inch woven-wire fence, having a 4-inch triangular mesh; 6 inches higher a barbed wire; 8 inches above this a second barbed wire. Total height, 59 inches.

Plate I shows the coyote-proof fence and the hunter with hounds patrolling it.

PLAN OF OBSERVATION.

The fence was repaired between May 10 and May 15, before the coyotes drifted back to the summer range from the winter and spring ranges below. Previously the Forest Service hunter, J. K. Carper, made a few trips of inspection to the area, and reported that bears and deer were passing through the pasture and that there was evidence of coyotes inside the fence. Before the holes were filled up and the gates closed the inclosure was carefully hunted with hounds. The only animals tracked were bears, deer, badgers, and porcupines. Coyotes had been inside, but had gone out before the hounds appeared. For three days before June 22, when the sheep were put in, the area was again carefully hunted for predatory animals. Bears had been passing through at will, and deer were still inside, but no coyotes had entered, although there were many in the neighborhood after June 1.

When the sheep were turned loose, June 22, the hunter began his work of patrolling the fence with hounds. From that date until September 27, with a few exceptions, the 8 miles of line was inspected each morning and a record made of all animals that came to the pasture and the attitude of each toward the fence. This was done both to protect the sheep against bears and to determine the efficiency of the fence against each kind of predatory animal.

METHOD OF OBSERVATION.

THE HOUNDS.

Without hounds it would be very difficult to determine whether predatory animals were in the pasture or not, unless sheep were killed. Accordingly, the hunter was provided with one foxhound, two mixed foxhound, bloodhound, and bulldog, and during part of the season two dogs of staghound and foxhound breed. For the work of patrolling the foxhound was relied upon almost entirely. His scent was very keen and his ability to distinguish between the forward track and the back track was seldom at fault.

THE TRAIL.

Any animals that came to the fence during the night could be trailed on the following day if the track was reached before the dew entirely evaporated. When the hounds "picked up" a trail, the hunter endeavored to find out what kind of animal had passed and what had been its attitude toward the fence. Occasionally the dogs would follow a hot track for miles from the pasture. On such occasions the fence inspection was completed, but a complete record of animals could not be secured without the hounds. Many trails around the fence were missed in this way.

Table 1, compiled from the daily reports of the hunter, shows the number and kind of animals actually observed and the efficiency of the coyote-proof fence as a protection against them.

TABLE 1.—*Efficiency of the fence.*

Period.	Animal.	Came to fence.	Got through fence.	Turned away.	Killed by hunter.
1909.					
June 25–Sept. 26	Coyotes	166	0	166	7
May 1–Sept. 26	Grizzly bear	0	0	0	[a]1
Do	Brown bears	4	1	[b]3	[c]7
June 25–Sept. 26	Lynx	1	0	[b]1	0
Do	Badgers	3	3	0	2

[a] Killed near pasture; no attempt to go through fence.
[b] Apparently no attempt to go through fence.
[c] Six taken near pasture; three were cubs not killed.

ATTITUDE OF ANIMALS TOWARD THE FENCE.

COYOTES.

From one to five coyotes were recorded for each of eighty days out of the ninety days of test. Many times they were on every side of the pasture in one night, and occasionally one would follow the fence line for 5 or 6 miles. Seven were shot or trapped along the line between June 22 and September 25, yet not one passed through, over, or under the fence during the experimental period. However, when the fence was repaired in May of 1909 there was some indication of attempts by coyotes to scratch under the wire. The animals were those that had gone in on the deep snow and had found themselves inclosed when the snow melted. Apparently they considered it a trap and began working to get out. In one place there was evidence of one having tried to scratch under in five places within a space of 3 rods. Where the final effort was made the hole was somewhat larger than the others, and there was a good deal of fur left on the bottom barbed wire. Evidently the animal had succeeded in forcing his way through. Later, during the experimental period, June 22 to September 29, there was evidence of one having attempted to scratch under from the outside, but a pole nailed securely to the bottom wire on the inside was an effective barrier, and the coyote turned away. This data, added to observations on the depth to which coyotes often dig to find field mice, leads to the belief that they can dig under such a fence. Should they do so, an extra wire placed on the ground on the inside face of the fence posts would, in all likelihood, keep them out. A better arrangement would be to have the extra barbed wire on the outside 6 inches from the fence and just above the ground surface, though this might result in injury to horses and cattle on the outside range. With the wire on the outside the coyote could not work near the fence, and in either case it is doubtful if he would be persistent enough to dig the distance that would be necessary in order to go under both wires.

COYOTE-PROOF FENCE AND HUNTER WITH HOUNDS PATROLLING IT.

BEARS.

Between May 1 and September 25, one large grizzly bear, three grown brown bears, and three brown bear cubs were killed or captured within a few miles of the pasture. Before June 22 bears had been going in and out of the inclosure to dig for food on the scab glades. The attacks on the fence were made, as reported in Forest Service Circular 160, by going between the woven wire and the first barbed wire above, leaving a space usually of about 20 inches. After June 22 one bear came to the line, and two that were killed were jumped by the hounds near the pasture, but apparently no effort was made to get through the fence. The conclusion of 1908 on this point may be repeated: Wherever the coyote-proof fence crosses the path of a bear he will go through it.

BOBCATS.

No conclusive data have been collected on the attitude of bobcats toward the fence. In 1908 one cat went in and out of the inclosure over a tree that had fallen across the wire. Others came to the line but made no attempt to get through. In 1909 no cats were seen or trailed anywhere near the experimental area. The effectiveness of the fence in keeping out bobcats, therefore, is still problematic. It is probable, however, that they can jump the fence, climb the posts, or climb the woven wire if they try to do so.

LYNXES.

In 1909 one lynx was reported by the hunter, but it merely came to the fence and turned away. In 1908, however, lynxes went through or over the fence a number of times, and it is not probable that it will exclude them at all.

BADGERS.

Badgers dug under the wire in fifteen places during the interval between October 1, 1908, and May 15, 1909. During the experimental test, June 22 to September 29, 1909, they dug under in four places. Where badgers are prevalent the fence should be inspected frequently and the holes made by their digging under the wire should immediately be closed to prevent coyotes from going through them.

The fact that the fence will not keep out bears, cats, and lynxes is not a discouraging feature. It has been reported by sheep owners and herders that in some localities bobcats kill a good many sheep, but with trailing hounds they can be treed and killed without difficulty. Lynxes are not abundant, except perhaps in a few remote localities, and the damage done by the lynx is very little. On a few mountain summer ranges bears occasionally attack the flocks and kill from one to twenty sheep in a single night. These depredations, however, usually are the work of a small number of bears, and a good

hunter should be able to kill them off. With the coyote the problem is different. Coyotes seem to increase in number as settlement increases. They follow the sheep from the feed yard to the summer range and back again; they work on the band by night and by day for twelve months in the year, and their attacks are made with cunning and stealth. They locate the herder and the dogs, and then work on the opposite end of the band, out of gun range, killing perhaps only one sheep, but not infrequently cutting off a small bunch so effectively that the herder does not miss them.

ACTIONS OF EWES AND LAMBS AT LIBERTY IN THE INCLOSURE.

In 1908 a band of Merino and Rambouillet ewes with Rambouillet lambs, 2,209 in all, was grazed on the area from June 21 until September 25. On June 22, 1909, 1,012 Merino and Rambouillet ewes, with 930 lambs sired by Shropshire rams, were put in the inclosure. On July 6, 98 three-fourths Shropshire yearlings were added to the band, making a total of 1,110 grown sheep and 930 lambs. These were grazed on the area until September 29.

The sheep were furnished by Mr. J. H. Dobbin, under an agreement that the Forest Service officers in charge should have entire direction of the work.

OBSERVATIONS MADE.

During the experimental test of 1909 the endeavor was made, as in 1908, to keep track of all the sheep from the time they left the bed ground in the morning until they bedded again at night. The tendency of the band to separate into small bunches, the tendency toward open, quiet grazing, habits of bedding, as well as all the difficulties that arose requiring the care of an attendant were carefully noted each day throughout the season. The primary object of such detailed study was to collect data from which conclusions on the following essential points might finally be drawn:

1. The amount of care that is necessary under such a system of grazing to secure good results and the number of sheep that one man can properly care for in pastures.
2. The factors that result in the increase in the weight of lambs and the increase in the carrying capacity of the range under the pasturage system, as compared with the methods of herding on the open range.
3. To what extent can the results of the pasturage system be secured on the open range by modifying the present methods of herding.

In Table 2 have been put the daily observations for the season, in order that the sheepman may, to some extent, make his own comparison of the actions of sheep when not herded and when herded. The column on remarks shows the number of times the bunches were driven together in order that ewes and their lambs would not remain too long apart.

TABLE 2.—*Actions of 2,038 ewes and lambs within coyote-proof inclosure.*

Date.	Time of day.	Number of bunches.	Approximate number of sheep in each bunch.	How grazing.	Where bedding.	Distance traveled.	Remarks.
June 22	7 a. m.	1	1,942	Counted into pasture			Previously grazed near pasture.
	8 p. m.	1	1,942	Bedding	Bed No. 1.		
23	4 a. m.	1	1,942	Leaving bed			
	8 p. m.	1	1,942	Bedding	Bed No. 2.	1 mile	Bed 2, ½ mile from bed 1.
24	4 a. m.	1	1,942	Leaving bed			
	12 a. m.	2	1,200-1,100	Open grazing		½ mile	Two bunches close together.
	3 p. m.	1	1,942	do		¾ mile	
	8 p. m.	1	1,942	Bedding	Bed No. 3.	1½ miles	
25	4 a. m.	1	1,942	Leaving bed			
	7 a. m.	2	300-1,700	Open grazing		½ mile	
	9 a. m.	3	300-500-1,200	do		¾ mile	
	7 p. m.	3	300-500-1,200	do			
	8.30 p. m.	1	1,942	Bedded	Bed No. 1.	1, 2, and 2½ miles	Came together on bed.
26	4 a. m.	1	1,942	Leaving bed			
	All day.	1	1,942	Open grazing	Bed No. 4.	1¼ miles	Bed 4, 1 mile from bed 1.
27	4 a. m.	1	1,942	Away from bed			
	3 p. m.	2	1,300-700	Open grazing		1 mile	Separated after noon.
	7 p. m.	1	1,942	Bedding	Bed No. 4.	1½ miles	Came together at bed.
28	4 a. m.	1	1,942	Away from bed			
	6.30 a. m.	2	100-1,850	Timber grazing			
	4 p. m.	1	1,942	Open grazing			
	8 p. m.	1	1,942	Bedding	Bed No. 4.	1 mile	
29	4 a. m.	1	1,942	Leaving bed			
	All day.	1	1,942	Open grazing	Bed No. 4.	1½ miles	
30	4 a. m.	1	1,942	Leaving bed			
	7.30 a. m.	2	1,000-1,000	Scattered in timber		½ mile	Separated in timber.
	2.30 a. m.	3	200-150-1,600	do		¾ mile	Do.
	4.30 p. m.	4	200-150-900-700	do		¾ mile	Do.
	8 p. m.	1	1,942	Bedding	Bed No. 5 (new)	1 mile	Two small bunches driven in because they were made up mainly of lambs.[a]
July 1	4 a. m.	1	1,942	Leaving bed			
	2 p. m.	2	1,450-500	Grazing openly on glades		¾ mile	
	6 p. m.	2	1,450-500	do	Bed No. 4.	1 mile	Came together on bed.
2	All day.	1	1,942	Much scattered	Bed No. 6.	1½ miles	
3	4 a. m.	1	1,942	Leaving bed			
	1 p. m.	2	400-1,500	Open grazing		1½ miles	Separated on glade.
	6 p. m.	1	1,942	do	Bed No. 3.	1½ and 1 mile	Came together at 6 p. m.
4	All day.	1	1,942	Widely scattered	Bed No. 7.	1 mile	
5	All day.	1	1,942	do	Bed No. 8.	1½ miles	
6	4 a. m.	1	1,942	Leaving bed			
	2.30 p. m.	2	1,500-400	Open grazing on glades			Separated at 2.30 p. m.
	8 p. m.	1	1,942	Bedding	Bed No. 1.	1½ miles	Small bunch driven in.[a]

[a] Small bunch put with band to prevent weaning of lambs.

TABLE 2.—*Actions of 2,038 ewes and lambs within coyote-proof inclosure*—Continued.

Date.	Time of day.	Number of bunches.	Approximate number of sheep in each bunch.	How grazing.	Where bedding.	Distance traveled.	Remarks.
July 7	4 a. m.	1	1,942	Leaving bed			Rainy day.
	7 a. m.	2	900–950	In timber		½ mile	
	9 a. m.	1	1,942	On glade		¾ mile	
	2 p. m.	2	1,000–900	Scattered on glades		1 mile	
	8 p. m.	2	1,000–900	Bedding	Beds Nos. 9, 10	1¼ miles	96 head three-fourths Shropshire yearlings turned loose with band July 7.
8	4 a. m.	2	1,000–1,050	Leaving beds			Beds 9 and 10, ¾ mile apart.
	8 a. m.	4	450–300–300–1,000	Scattered in timber		¼, ¼, ¼, and ½ mile	Separated in timber.
	9 a. m.	2	300–1,750	Shaded up			
	3 p. m.	1	2,040	Open grazing on glade			
	8 p. m.	1	2,040	Bedding	Bed No. 10	¾ and 1 mile	
9	4 a. m.	1	2,040	Leaving bed			
	10.30 a. m.	6	All small.	Widely scattered in timber			Separated in timber 10 a. m.
	3 p. m.	3	700–700–700	Scattered grazing in timber			
	8 p. m.	1	2,040	Bedding	Bed No. 11 (new)	¾ mile	Grazed timber all day; came together at bed.
10	Until 4 p. m.	1	2,040	Very widely scattered			
	4 p. m.	2	1,200–700	do			Separated on glade.
	8 p. m.	1	2,040	At bed ground	Bed No. 11	1 mile	Came together on bed.
11	4 a. m.	1	2,040	Away from bed			
	8 a. m.	2	200–1,800	Scattered on glades		½ mile	
	9 a. m.	3	200–1,000–800	Scattered in open timber			
	10 a. m.	1	2,040	do		1 mile	
	8 p. m.	1	2,040	Bedding	Bed No. 11	1½ miles	
12	4 a. m.	1	2,040	Away from bed			
	3 p. m.	2	1,000–1,040	Scattered grazing		1 mile	
	5 p. m.	3	1,000–500–540	do		1½ miles	
	8 p. m.	1	2,040	Bedding	Bed No. 12	1½ miles	Came together 6 p. m. at bed.
13	All day	1	2,040	Widely scattered	do	1 mile	Covered ½ mile square most of day.
14	Until 3 p. m.	1	2,040	do			
	3 to 7 p. m.	2	2,040	do			
	8 p. m.	1	2,040	Bedded	Bed No. 12	1 mile	Quiet grazing all day.
15	Until 2 p. m.	1	2,040	Very widely scattered		½ mile	
	2 to 8 p. m.	3	200–1,000–800	do			
	8 p. m.	2	200–1,800	Bedding	Beds Nos. 12, 13	¾ mile	Do.
16	4 a. m.	1	2,040	Leaving bed			
	3 p. m.	3	1,000–200–800	Scattered grazing		1 mile	Bunches ½ mile apart.
	8 p. m.	1	2,040	Bedding	Bed No. 12	1½ miles	Trailed ½ mile to bed.
17	4 a. m.	1	2,040	Away from bed			
	7 a. m.	1	2,040	Shaded up		½ mile	Usually shade up before 8 a. m.
	3 p. m.	4	200–1,000–400–400	Scattered in timber		1 mile	Separated in timber.
	8 p. m.	2	400–1,640	Bedding	Beds Nos. 12, 14	1¼ and 1½ miles	Main bunch trailed ½ mile to bed.
18	4 a. m.	2	400–1,640	Leaving beds			

	9 a. m.	1	2,040	Open grazing		¾ mile	Trailed ½ mile from bed.
	3 p. m.	4	500–500–600–400	Much scattered in timber		1 mile	
	5 p. m.	2	1,000–1,000	do		1½ miles	
	8 p. m.	1	2,040	Bedding	Bed No. 15	1¼ miles	Came together at bed ground.
19	Until 1 p. m.	1	2,040	Scattered in heavy timber		¼ mile	
	Afternoon	3	1,400–200–400	do	Beds Nos. 15, 16, 17	½ mile	Much scattered in timber all day.
20	4 a. m.	3	1,400–200–400	do			
	8 p. m.	1	2,040	Bedding	Bed No. 10	1 mile	Widely scattered in heavy timber all day.
21	4 a. m.	1	2,040	Leaving bed			
	7 a. m.	2	1,800–200	Open grazing			
	3 to 8 p. m.	3	200–500–1,300	do	Beds Nos. 12, 18, 19	½, 2, and 1½ miles	Beds 1 mile apart.
22	7 a. m.	3	200–500–1,300	Scattered in timber			
	4 p. m.	4	200–500–600–700	do			
	8 p. m.	3	200–500–1,300	Bedding	Beds Nos. 10, 12, 20	1 mile	Beds ¾ mile apart.
23	4 a. m.	3	200–500–1,300	Leaving beds			
	7 a. m.	4	200–500–1,000–300	Scattered in timber			
	8 p. m.	2	500–1,500	Bedding	Beds Nos. 21, 22		Two small bunches driven in. They had been apart 2 days.[a]
24	Until 9 a. m.	2	500–1,500	Open grazing and "shading"			At 9 a. m. all driven together.[a]
	9 a. m. to 8 p. m.	1	2,040	Scattered in timber	Bed No. 4	1 mile	
25	Until 11 a. m.	1	2,040	do		½ mile	
	11.30 a. m.	2	1,400–640	Much scattered			
	3 p. m.	3	1,400–440–200	do			
	8 p. m.	3	1,400–440–200	Bedding	Beds Nos. 23, 24, 25	¾ mile	Well scattered and quiet all day.
26	Until 9 a. m.	3	1,400–440–200	Scattered not far apart			At 9 a. m. 2 bunches driven in on account of lambs.[a]
	9 a. m. to 3 p. m.	1	2,040	Widely scattered			
	3 p. m.	2	1,000–1,040	In timber and glades			
	8 p. m.	1	2,040	Bedding	Bed No. 5	½ mile	
27	8 a. m.	2	1,000–1,040	Bunched up			Heavy storm all day.
	12 a. m.	1	2,040				
	3 p. m.	3	1,000–600–400	In timber			
	8 p. m.	3	1,000–600–400	Bedding	Not located	1½ miles	Heavy storm; sheep did not permanently bed down.
28	9 a. m.	6	10–150–300–900–1,000–200	Widely scattered			
	2 p. m.	3	1,000–400–650	Scattered in timber			
	8 p. m.	2	1,650–400	Bedding	Beds Nos. 4, 23	1 mile	One small bunch driven in at 5 p. m.[a]
29	6 a. m.	1	2,040	In timber			
	7 a. m.	2	600–1,400	Scattered in timber		½ mile	Came together and again divided.
	2 p. m.	5	600–600–150–400–300	do		¾ mile	All in timber.
	8 p. m.	5	600–600–150–400–300	Bedding	Beds Nos. 1, 4, 25, 26	1 mile	
30	Until 1 p. m.	5	600–600–150–400–300	Scattered grazing			
	2 to 8 p. m.	2	200–1,850	Bedding	Beds Nos. 25, 27	½ and 2 miles	Widely scattered all day.
31	All day	2	200–1,850	Open grazing		1½ and ¾ miles	
	8 p. m.	1	2,040	Bedding	Bed No. 28		Small bunch driven in.[a]
Aug. 1	Until 9 a. m.	1	2,040	Openly in timber		½ mile	
	9 a. m. to 8 p. m.	2	400–1,650	Scattered in timber	Beds Nos. 29, 30	¾ and 1¼ miles	Beds 1 mile apart.
2	Until noon	2	400–1,650	do		½ mile	

[a] Small bunch put with band to prevent weaning of lambs.

TABLE 2.—*Actions of 2,038 ewes and lambs within coyote-proof inclosure*—Continued.

Date.	Time of day.	Number of bunches.	Approximate number of sheep in each bunch.	How grazing.	Where bedding.	Distance traveled.	Remarks.
Aug. 2	Noon to 5 p. m.	5	400–400–800–200–250	Scattered in timber		¾ mile	Scattered for 2 miles.
	8 p. m.	3	400–600–1,050	Bedding	Beds Nos. 2, 28, 31	1½ miles	Came together late in evening.
3	Until 7 p. m.	3	400–600–1,050	Scattered grazing		¾ mile	
	8 p. m.	2	1,850–400	Bedding	Beds Nos. 32, 33	1½ and ¾ miles	Small bunch driven in.[a]
4	9 a. m.	1	2,240	Scattered on glades		½ and ¾ mile	400 head driven to band.[a]
	3.30 p. m.	4		Scattered in heavy timber			
	8 p. m.	2	1,500–550	Bedding	Old beds		Two beds ¼ mile apart.
5	6 a. m.	1	2,200	Widely scattered		½ mile	
	1 p. m.	4	400–400–800–400	Scattered in timber			
	5 p. m.	5	300–100–400–800–400	do			
	8 p. m.	2	400–1,650	Bedding	Beds Nos. 34, 35	¾ mile	4 bunches came together at bed.
6	6 a. m.	3	400–600–1,050	Scattered on glades			Large bunch separated at bed.
	7 a. m.	2	1,450–600	Widely scattered			Bunches apart at night came together.
	8 p. m.	2	1,450–600	Bedding	Beds Nos. 31, 36	1 and ½ mile	Beds ½ mile apart.
7	7 a. m.	1	2,040	Shaded up			Came together at 6.30 a. m.
	9 a. m. to 8 p. m.	2	600–1,440	Bedding	Beds Nos. 31, 35	¾ mile	Beds ½ mile apart.
8	5 a. m.	2	600–1,400	Leaving bed			
	8 a. m.	4	600–500–300–600	Scattered in heavy timber		½ mile	Bunches strung for 1½ miles.
	9.30 a. m.	2	600–1,400	Widely scattered in timber		½ and ¾ mile	
	1 to 8 p. m.	3	200–400–1,400	do	Beds Nos. 32, 37, 38	¾, ¾ and 1 mile	
9	5 a. m.	3	200–400–1,400	Leaving bed			
	4 p. m.	2	1,600–400	Scattered in timber		½ mile	
	5 p. m.	3	1,200–400–400	do		¾ and ½ mile	Came together and immediately separated again.
	8 p. m.	2	1,600–400	Bedding	Old beds	1 and ¾ mile	
10	5 a. m.	2	1,600–400	Leaving bed			
	10 a. m. to 6 p. m.	1	2,040	Scattered in timber		¾ and ½ mile	Grazed together in timber.
	8 p. m.	2	1,000–1,000	Bedding	Beds Nos. 11, 34	1 and 1 mile	Separated at 7 p. m. and bedded ½ mile apart.
11	10 a. m. to 8 p. m.	1	2,040	Scattered grazing	Bed No. 34	1 and 1½ miles	Grazed together at 10 a. m.
12	Until 4 p. m.	1	2,040	Scattered in timber		¾ mile	
	8 p. m.	3	250–800–1,000	Bedding	Beds Nos. 3, 32, 39	¾, 1 and 1¼ miles	Beds ½ mile apart.
13	Until 1 p. m.	3	250–800–1,000	Open grazing		½ and ½ mile	
	1 to 5 p. m.	2	250–1,800	Scattered mainly in timber		¾ and ⅝ mile	
	8 p. m.	4	250–600–300–900	Bedding	Beds Nos. 3, 11, 40, 34	1 and ½ mile	Beds from ½ to ½ mile apart.
14	7 a. m.	3	1,150–600–300	Scattered in timber			2 bunches bedding ¼ mile apart, came together 1 hour after leaving beds.
	3 p. m.	4	600–500–300–600	Scattered widely			
	8 p. m.	3	600–500–900	Bedding	Beds Nos. 10, 41, 32	About 1 mile	Very quiet, grazing all day.
15	Until 4 p. m.	3	600–500–900	Scattered widely		½, 1½, and 1 mile	One bunch trailed a good deal.
	8 p. m.	2	1,100–900	Bedding	Beds Nos. 4, 5	¾, 1¾, and 1¼ miles	Beds ¼ mile apart.
16	6.30 a. m.	3	900–200–900	Scattered widely			
	9 a. m.	1	2,040	Scattered ½ mile			200 head driven to main band.[a]

	4 p. m.	4	400–400–800–450	Widely scattered			
	8 p. m.	3	800–800–450	Bedding	Beds Nos. 4, 39, 42	1½ miles	Traveled a good deal.
17	Until 12 a. m.	3	800–800–450	Open grazing		1 mile	
	3 p. m.	2	800–1,250	do		1 and 1¼ miles	
	5 p. m.	4		Scattered in timber			
	8 p. m.	1	2,040	Bedding	Bed No. 4	1 to 2 miles	Came together on bed.
18	Until 8 a. m.	1	2,040	Open grazing		½ mile	
	8.30 a. m.	3	150–600–1,300	Scattered in timber		¾ mile	
	8 p. m.	3	150–600–1,300	Bedding	Beds No. 43, 1 old bed		1 bunch not located.
19	7 a. m.	5	500–150–600–150–600	Very much scattered		¼ mile	
	3 p. m.	6		do		½ mile	
	5 p. m.	8		do			
	8 p. m.	4	600–150–300–1,000	Bedding	Beds Nos. 44, 45, 5, 41	From ¾ to 1 mile	Very widely scattered all day.
20	Until 4 p. m.	4	600–150–300–1,000	Scattered widely			In timber.
	4.30 p. m.	5	600–150–300–600–400	do			
	8 p. m.	3	150–600–1,300	Bedding	Beds Nos. 46, 47, 11	From ¼ to 2 miles	Bedding 1½ miles apart.
21	8 a. m.	2	150–1,900	Scattered in open timber		¼ and ½ mile	
	4 p. m.	4	150–800–600–500	Scattered in heavy timber		¼ and ½ mile	
	8 p. m.	3	150–800–1,100	Bedding	Beds Nos. 48, 49, 11	½, 1½, and 1½ miles	Widely scattered all day.
22	7 a. m.	2	150–1,900	Widely scattered		¼ mile	
	3 p. m.	4	150–400–1,000–500	do		¼ and ½ mile	
	8 p. m.	2	150–1,900	Bedding	Beds Nos. 4, 10	½ and ¾ mile	Beds 1½ miles apart.
23	10 a. m.	4	150–800–300–800	Scattered grazing		½ mile	At 10.30, 150 head put with band.[a]
	7 p. m.	2	300–1,750	Bedding	Beds Nos. 11, 10	From ½ to 2 miles	Widely scattered until evening.
24	All day	2	300–1,750	Very widely scattered		¾ mile	1 bunch strung for ¾ mile.
	8 p. m.	1	2,040	Bedding	Bed No. 11	1 mile	Came together on bed.
25	Until 3 p. m.	1	2,040	Over ½ mile square		½ mile	
	3 p. m.	2	800–1,250	Scattered in timber		1 and ¾ mile	
	5 p. m.	1	2,040	Bunched up		1 and 1 mile	
	8 p. m.	2	1,500–550	Bedding	Beds Nos. 11, 13	1 and 1½ miles	Separated late in evening.
26	8 a. m.	4	800–150–500–600	Widely scattered		½ mile	Separated just after leaving bed.
	8 p. m.	4	800–150–500–600	Bedding	Beds Nos. 50, 51, 52, 4	From ½ to 2 miles	
27	7 a. m.	5	800–150–150–600–350	Widely scattered			
	8 p. m.	5	800–150–150–600–350	Bedding	Beds Nos. 11, 53, 54, 55, 10.	From ½ to 2½ miles	Beds 2 miles apart.
28	All day	5	800–150–150–600–350	Scattered in timber	Beds Nos. 56, 57, 4, 10.	From ½ to 2 miles	One bed not located.
29	do	5	800–150–150–600–350	Widely scattered	Beds Nos. 32, 11, 58, 59, 60.	From ¼ to 1½ miles	
30	do	5	800–150–150–600–350	do	Beds Nos. 11, 5, 61	From ½ to 1 mile	Two beds not located.
31	do	5	800–150–150–600–350	do	Beds Nos. 4, 35, 5	From ½ to 2 miles	Do.
Sept. 1	10 a. m.	1	2,040	Open grazing		½ and 1 mile	Came together between 8 and 10 a. m.
	8 p. m.	2	1,700–350	Bedding	Beds Nos. 32, 62	1 and 1½ miles	Beds ½ mile apart.
2	7 a. m.	1	2,040	Widely scattered		½ mile	
	2 p. m.	4	100–350–400–1,200	Bedding	Beds Nos. 63, 64, 4, 40	From ½ to 2½ miles	Beds from ½ to 2 miles apart.
3	Until 4 p. m.	4	100–350–400–1,200	Widely scattered			
	8 p. m.	2	350–1,700	Bedding	Beds Nos. 4, 11	From ½ to 2 miles	Came together at bed.
4	12 a. m.	4	150–300–500–1,100	Scattered in timber		½ mile	
	8 p. m.	3	150–500–1,400	Bedding	Beds Nos. 4, 11, 35	½ and 2 miles	Two bunches came together on Bed No. 11.
5	9 a. m.	4	150–500–1,000–400	Scattered in timber		½ mile	

[a] Small bunch put with band to prevent weaning of lambs.

TABLE 2.—*Actions of 2,038 ewes and lambs within coyote-proof inclosure*—Continued.

Date.	Time of day.	Number of bunches.	Approximate number of sheep in each bunch.	How grazing.	Where bedding.	Distance traveled.	Remarks.
Sept. 5	8 p. m.	3	150-900-1,000	Bedding	Beds Nos. 4, 5, 65	½ and 1½ miles	Two bunches came together at bed.
6	All day	3	150-900-1,000	Scattered in timber	Beds Nos. 4, 11, 66	¼ mile	
7	11 a. m.	5	150-300-300-900-400	Widely scattered		¼ and ½ mile	
	8 p. m.	4	150-300-300-1,300	Bedding	Beds Nos. 67, 68, 69, 12.	½ and 1½ miles	Two bunches driven together.[a]
8	All day	4	150-300-300-1,300	Scattered in timber		½ mile	
	7 p. m.	2	150-1,900	Bedding	Beds Nos. 10, 70	¼ and ½ mile	3 bunches gathered up in evening to weigh lambs; 1 bunch could not be located.
9	All day	2	150-1,900	Open grazing		½ mile	
	7 p. m.	1	2,040	Bedding	Bed No. 71	½ and 2 miles	Small bunch driven to band.[a]
10	7 a. m.	2	1,000-1,020	Widely scattered			
	8 p. m.	2	1,000-1,020	Bedding	Beds Nos. 72, 73	½ mile	Scattered ½ mile square all day.
11	11 a. m.	1	2,040	Widely scattered		¾ mile	Snow storm caused much trailing.
	3 p. m.	2	900-1,150	do		1 mile	
	8 p. m.	2	900-1,150	Bedding	Beds Nos. 74, 75	1½ miles	Beds ¼ mile apart.
12	7 a. m.	1	2,040	Scattered in timber		¼ and ½ mile	Came together 1 hour after leaving bed.
	8 p. m.	1	2,040	Bedding	Bed No. 74	¾ mile	Scattered ½ mile square all day.
13	All day	1	2,040	Widely scattered	do	1 mile	
14	do	1	2,040	do	do	1 mile	
15	8 a. m.	3		do		½ and 1 mile	Separated in timber.
	8 p. m.	3		Bedding	Beds Nos. 71, 68, 76	¼ and 1½ miles	
16	All day	3		Open grazing		¼ mile	
	8 p. m.	2		Bedding	Beds Nos. 74, 77	¾ mile	Two bunches came together in evening.
17	8 a. m.	1	2,040	Open grazing		¼ mile	
	9 a. m.	2	600-1,450	Scattered in timber		¾ mile	
	8 p. m.	1	2,040	Bedding	Bed No. 74	¾ mile	Came together at bed.
18	9.30 a. m.	3	600-700-750	Widely scattered		¾ mile	In timber all day.
	8 p. m.	3	600-700-750	Bedding	Beds Nos. 4, 32, 75	¾ mile	
19	7 a. m.	4	600-500-200-750	Widely scattered		¼ and ½ mile	
	8 p. m.	4	600-500-200-750	Bedding	Beds Nos. 4, 74, 32, 76	½ and 2 miles	Feed getting short and sheep moved about considerably.
20	7 a. m.	5	600-500-200-500-250	Widely scattered			
	8 p. m.	4	850-500-200-500	Bedding	Beds Nos. 74, 10, 5, 32	½ and 2 miles	
21	All day	4	850-500-200-500	Open grazing	Beds Nos. 12, 2	¼ and 1½ miles	Two beds not located.
22	9 a. m.	5	850-200-250-250-500	do			Distributed over entire pasture.
[b] 28	7 a. m.	5	700-200-300-300-550	do			When rounded up Sept. 28 the 5 bunches were in different parts of the pasture, widely separated.

[a] Small bunch put with band to prevent weaning of lambs.
[b] September 23 to 27 no accurate observations made. Sheep were scattered in small bunches over entire pasture.

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AREA SUPPORTING AN ABUNDANCE OF ATTRACTIVE FLOWERING PLANTS AND SMALL CLOVER.

Loss of sheep during the pasture period, June 22 to September 29, 1909.

September 29, 7 a. m., the experiment was closed and the sheep counted and turned over to the owner.

Count turned into the pasture, June 22, 1909	1,942
Count turned into the pasture, July 6, 1909	98
Loss during season, June 22 to September 29, 99 days:	
a. By poisonous plants—	
Ewe[a]	1
Lambs	0
b. From "bluebag," ewes	2
c. On back between logs, ewe	1
d. Sickness, undetermined, lamb	1
e. For mutton	3
Total	8
Count when taken from the pasture September 29, 1909	2,032
Total count	2,040
Actual loss in the pasture	4
Per cent loss in the pasture	0.2

DISCUSSION.

SEPARATING INTO SMALL BUNCHES.

In order to handle a band of ewes and lambs under the pasturage system in a way best both for the forage crop and for the sheep it is essential to know: First, the extent to which the ewes and their lambs will naturally be separated from each other and remain apart; second, to what extent the ewes and their lambs may separate and remain apart without retarding the growth of the lambs, or without loss of ewes from inflammation of the udder, caused by an excess of milk; and, third, to what extent they should remain in small bunches in order to secure the best utilization of the forage crop.

Table 2 shows that during most of the time for the first twenty days after the sheep were turned loose in the pasture they were in one band. They would scatter widely and occasionally separate into two or three bunches for a short time during the day, but toward evening they would invariably work together. Except on two occasions they were together on the bed ground at night. This action, no doubt, was in part due to the fact that there was no heavy timber grazing during the period, but in greater degree to the tendency of each ewe to look after her lamb, and to the fact that the band had not yet outgrown the habits acquired while herded. As the season advanced the actions of the sheep were characterized by greater freedom. Table 2 shows that the number of bunches was from 1 to 8, the number of sheep in each bunch varying from 10 to 2,040 head.

[a] One ewe, poisoned before entering pasture, died immediately afterwards.

After the first month the sheep were constantly coming together and separating again, the size of bunches varying with each separation. They were seldom in one band for any length of time. As soon as the lambs had been suckled they were content to wander off again. During the last six weeks of the test the ewes and lambs cared very little whether they were together or not. The band was usually in many small bunches so widely distributed over the 2,560 acres that it was difficult even to keep track of them.

The number and size of bunches as well as the time that they are apart will depend upon the size and topography of the inclosure, the acreage and distribution of heavily forested areas, the length of time that the sheep have been without a herder, the condition of the forage crop, atmospheric conditions, and especially the age of the lambs.

On an untimbered area the sheep would scatter widely, but would seldom be apart any length of time. In a heavily forested inclosure they would separate more frequently, and would not come together as easily. After having been herded, it takes them some time to depart from their old habits and accommodate themselves to the freedom of the pasture. When the forage is plentiful and of choice quality they are quickly satisfied, and the tendency to run about is not so great as it is when the main crop dries and a sparse growth of green grass appears in the fall. The main factor, however, is the tendency of each ewe to look after her lamb. This attention on the part of the ewe gradually becomes less as the season advances and the lamb becomes less dependent upon the mother for support. Consequently, the tendency to separate increases.

As a rule, when a band the size of the one on the experimental area divides into small bunches many lambs are separated from their mothers. Usually, however, the bunches, in grazing about, come together often enough to prevent weaning the lambs and thereby retarding their growth, although occasionally it was necessary to put them together. During the entire month of August they were together on the bed ground only three times, yet it was thought necessary on only four occasions to drive small bunches to the main band on account of the lambs. In this connection it is essential to know to what extent they may remain apart without detrimental effect to themselves and to the range.

The time that a ewe and her lamb may be left apart depends upon the age of the lamb. For the first two days after birth he will make the best progress if he is suckled at intervals not exceeding two hours. The time between feeds may then gradually increase. After he begins to eat green, succulent forage, the milk is not so necessary in satisfying hunger, but is still essential to rapid growth, and he should not be away from the ewe for more than four or five hours. At 4

months of age he lives for the most part upon forage, but still the milk gives a roundness and beauty of growth that is not attained without it. However, at this age he can go all day, and occasionally longer, without being suckled, provided there is sufficient tender forage to satisfy his needs. If these natural requirements are kept in mind and judgment used in handling a band of ewes and lambs, there will be little danger to the ewe from accumulation of milk, and the growth of the lamb will not be retarded.

If the sheep are contented, the bunches can not be too small for the good of the range. But until the lambs are from 4 to 5 months old the small bunches made up of ewes whose lambs perhaps are in some other bunch and lambs whose mothers are elsewhere are restless after they have been separated from the band for several hours. As a result they move about considerably, to the detriment of both sheep and range. Toward the close of the season, when the lambs are practically independent of their mothers, the small bunches are contented and the destruction of forage by trampling is at a minimum. The aim, always, should be to keep the sheep contented and grazing quietly and openly. It may be advisable and even necessary at times to drive small bunches to the main band.

OPEN GRAZING.

It has already been said that the sheep should be contented and graze openly and quietly. Close bunched grazing, massing, running, and trailing should be prevented if possible. The destruction of forage by trampling is greatest when sheep are in large bunches, under herders who are continually using the dogs on the leaders and the "drag bunch" to make them keep pace with each other. It is least when the sheep are in small bunches, each ewe with her lamb at her side, grazing openly and quietly. The actions of the pasture band were not ideal in this respect, but the tendency to open quiet grazing was much more pronounced than under most herders, and it increased as the season advanced.

During the first month the entire band was together most of the time, but it spread out over so large an area and grazed so quietly that the unnecessary damage due to trampling was limited to occasional running and to trailing over pine grass areas from one choice glade to another. As the season advanced the sheep grew more independent of each other, were less easily frightened by any slight noise, and the number of small bunches increased. As a result, close bunched grazing was rare and there was very little trailing. Before the experimental period closed it was almost impossible to keep them close bunched without using a dog. Bunch them up and immediately they would spread out in every direction. They simply would not graze close bunched.

RAMBLING ABOUT.

Table 2 shows that the distance covered by the sheep during twenty-four hours varied from one-fourth mile to 2½ miles, the usual distance being 1 mile or less. The distance traveled varied considerably, even under the same conditions of forage crop and atmosphere. In general, sheep travel less when the forage is choice than when it is dry or scarce; less on hot days than on cool days; less in timber than on the untimbered areas, and less after the lambs are independent of the mothers than when they are from 3 to 4 months old. When the lambs are very young, of course, the ewes, if unmolested, will move about very little, but variations and exceptions will occur in each case.

Usually, small bunches move a shorter distance than larger bunches. A small bunch in some instances would graze for two or three days within a radius of one-fourth mile. The larger bunches would do this only when they were on a meadow area where there was abundance of attractive flowering plants and clover, as shown in Plate II. The shorter the distance traveled, the less energy is expended, but the distance covered in a day is not in itself a measure of the forage destroyed by trampling or needlessly wasted as energy. A large band of sheep will destroy more forage by coming together on the run, when scattered over 100 acres of ground, than they will by quietly grazing in one direction, well spread out, all day, even though they travel 2 miles. In the former case, twenty hoofs may strike the same plant, and each hoof act as a cutting edge. When they are quietly grazing, well spread out, few hoofs, perhaps only one, will strike a plant, and the impression of the foot is almost imperceptible. The ground is not packed, nor the seedlings uprooted, as by the massing.

There were times when the pastured sheep did more trailing than was desirable. During the first month the scab glades were covered with a luxuriant growth of succulent flowering plants, and while they lasted the sheep would eat nothing else. They would sweep across a small glade area, nipping off the flowers and choice leaves, then trail over an area of yellow pine land to reach the next glade. As a result, considerable pine grass and clover was beaten down and left to wilt. To some extent this damage could be eliminated if a tender had been present to check the leaders in their rapid march from one glade to another. Aside from this feature there was occasional trailing from the bed ground in the morning and to it at night. On the whole, however, comparatively little forage was destroyed by trampling.

BEDDING.

Column 6 of Table 2 shows that the number of bunches in which the sheep bedded varied from 1 to 5; that the number of bunches

bedded increased as the season advanced; that the number of bunches bedded, as a rule, was less than the number during the day; that the number of beds used, old and new, for a given period, increased as the season advanced; and that during the ninety-nine days of test, 77 different beds were used.

During the first month the tendency of the sheep to assemble for the night was very marked, but gradually decreased until it was almost negligible at the close of the season. During the first two weeks of test the band was separated at night only twice, while during the entire month of August they were together at night only three times. In the last two weeks of record they bedded in one band five times, but during this period they were grazing an area with few natural bed grounds and with barriers of dense timber that the sheep would not readily pass through during the cold weather of late September. Naturally, they came together at night on the few suitable bedding places. During the first week of test 4 beds were used; during the second week, 6; the third, 5; the fourth, 6; and the fifth, 12.

Again, from Table 2 it will be seen that beds Nos. 4, 11, and 32 were used many times. Each of these was on a prominent open point adjoining heavy timber, and, naturally, the sheep would work out of the timber at night and bed in the open near by. However, bed No. 32 extended over an area of approximately 30 acres on a rocky scab ridge. The effect of bedding was very beneficial rather than detrimental to the forage growth. The sterile soil among the rocks was fertilized, and seeds of forage plants were carried to it in the wool of the sheep. For the same reason, bed No. 4 was improved rather than impoverished. Bed No. 11 is the only place in the pasture that, perhaps, has been injured by excessive use. (For effect of bedding upon forage crop, see Plate IV.)

From the observations made it is safe to conclude that when the lambs are young the ewes will naturally come together at night, if many of them have been separated from their lambs during the day; that in an inclosure similar to the coyote-proof pasture the general tendency of the sheep will be to bed where night overtakes them, providing the place affords a suitable bedding ground; and, finally, that, with few exceptions, the bedding under this system will prove beneficial rather than detrimental to the forage crop.

In a small untimbered inclosure a band would be together much more during the day, and would bed in one place and in one bunch more frequently than was the case at the experimental pasture.

NUMBER OF SHEEP ONE MAN CAN CARE FOR IN PASTURE.

It is evident from the preceding discussion that sheep in pasture do not require a great amount of care, provided the fence is coyote-proof.

They should be salted at regular intervals, not exceeding ten days, preferably five days. During the period when flies are bad a few sheep, though very few, will need treatment to prevent loss from "flyblows." Aside from this, it is essential to see that ewes and their lambs do not remain too long apart during at least the first four months of the lamb's life. Neither should be disturbed unless it is necessary, and the need for interference should be based upon the actions of both ewe and lamb, the condition of the ewe's udder, and the appearance of the lamb. If contented, quiet, and making good progress they should not be molested. If any of the lambs appear to be gaunt and uneasy, or if there are ewes with distended udders caused by excess of milk, care should be given them. No set rules can be laid down to govern the shepherd in such cases. If he is accustomed to handling sheep he will know immediately when his flock is not doing as well as they should do.

In timbered areas the fence should be inspected frequently and kept in good repair. A well-trained foxhound will aid materially in ascertaining whether predatory animals have entered the inclosure. He will soon learn to be quiet when near the sheep, and may be allowed to follow the attendant about the pasture. If a predatory animal has entered, the track usually will be crossed somewhere during the rounds, and the hound will immediately make the fact known.

It is probable that one energetic man, who understands the nature of the difficulties that may arise, can properly care for four inclosures similar to the experimental coyote-proof pasture, inspecting two each day. In case of emergency, the four inclosures could be looked after in one day. Under such an arrangement one man would care for from 8,000 to 10,000 head of sheep.

EFFECTS OF THE PASTURAGE SYSTEM UPON THE SHEEP AND THE CARRYING CAPACITY OF THE RANGE.

The economic importance of the pasturage system of handling sheep can best be determined by a careful comparative study of the results obtained under this system and those obtained in the same or a similar locality under the herding system. The comparative results fall naturally into two divisions, the effect upon the sheep and the effect upon the carrying capacity of the range.

THE SHEEP.

In 1909, as in 1908, comparative data were secured on the loss of sheep during the season, the weight of lambs at the close of the season, the cost of handling, and, to some extent, on wool growth.

COMPARATIVE LOSS.

The experimental period at the coyote-proof pasture covered the summer season from June 22 to October 1, and, for this reason, the comparative losses given in Table 3 are for that period only.

TABLE 3.—*Loss of sheep.*

Owner.	Where grazing.	Period 1909.	Number of sheep.	Loss in sheep.	Per cent loss.
J. H. Dobbin	Coyote-proof pasture	June 22–Sept. 29	2,040	4	0.2
Do	Open range near coyote-proof pasture.	June 20–Sept. 27	2,628	53	2.0
Litch, Hotchkiss & Funk	do	June 27–Sept. 20	[a] 5,345	60	1.1
Do	do	do	[b c] 5,300	120	2.3
Baldwin [d]	do	do	2,660	[c] 80	3.0
Michellod & Robin [d]	do	do	3,000	[c] 30	1.0
J. H. Dobbin	High mountain range	June 20–Oct. 1	[e] 10,652	302	2.8
Frank Stubblefield [d]	do	June 20–Sept. 20	(*f*)	.....	[c] 3.0

[a] Fine-wool sheep.
[b] Coarse-wool sheep.
[c] Approximate.
[d] Final count not accurately secured, but the estimates are very close. The above losses would be a fair average for Wallowa National Forest for the summer period of grazing.
[e] Four bands.
[f] Two bands.

Table 3 shows the pasture loss as 4 head out of a band of 2,040, less than one-fifth of 1 per cent, while the loss from bands of 2,000 head on the outside varied from 20 to 60, or from 1 to 3 per cent. At market prices, October 1, 1909, this was equivalent to a loss of $16 from the pasture band as compared with approximately $200 from each outside band of the same number.

The marked difference in loss was due to several things. On the outside range small bunches occasionally are cut off from the main band, and, at best, some of the sheep are killed by predatory animals before the loss is known and the bunch found. Outside bands lose a few sheep by coyotes and bear in the timber during the day and on the bed ground at night.

The loss on outside range due to "piling up," timber snags, and bruises varies considerably with different herders. If a herder uses his dogs when the sheep are spread out in heavy timber, there is much danger of broken legs, snag wounds, and internal injuries from jamming, and perhaps, though rarely, a "pile up." In such cases the actual loss by death may be small, but the "hospital bunch" will be large and made up of sheep that are almost valueless. In 1908 a few head were lost from snags and bruises in the pasture, but in 1909 great care was exercised not to frighten the band at all, and not one sheep was lost from injuries. The "hospital bunch" consisted of one lamb with a broken leg.

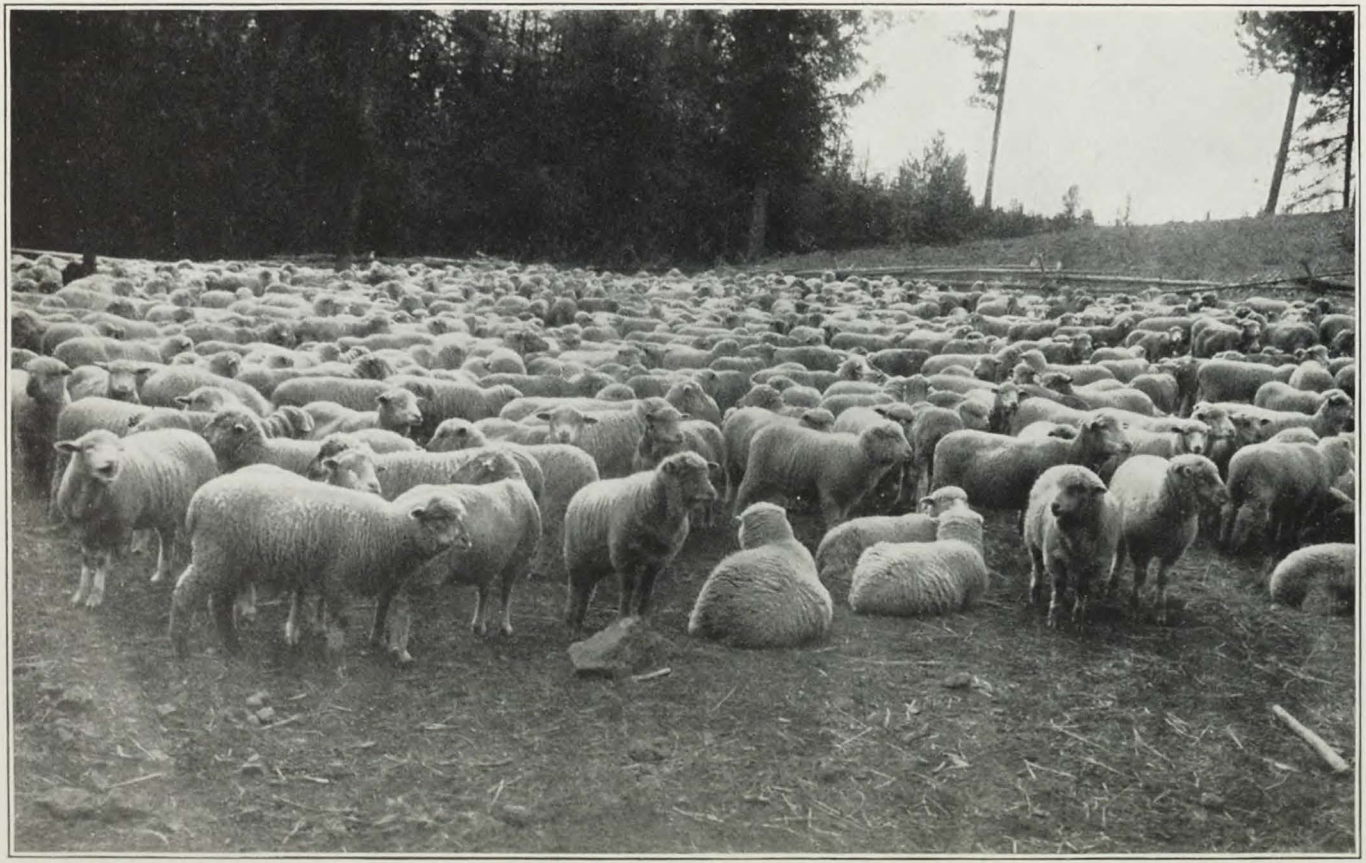
The losses from poisonous plants afforded interesting observations, and gave a few results that may prove of value to sheepmen in avoiding loss from this source. In 1908, and again in 1909, every band

which grazed on outside range adjoining the pasture sustained a loss from poisonous plants, varying from 5 to 40 head. The heaviest loss occurred where sheep had been driven all day and then turned on an area where lupine and purple larkspur (*Delphinium menziesii*) were prevalent. In a few instances the loss in a single night reached 30 head, mostly lambs. In 1908 the pastured sheep were turned loose in the afternoon, after having been driven some distance without grazing. Within thirty-six hours 5 lambs died. None died later, notwithstanding the fact that larkspur and lupine were present all over the inclosure. In 1909 the pasture band, before entering the inclosure, were on range adjoining the experimental area, and from 1 to 3 head died each day from poison. They were put into the inclosure in the morning and immediately placed on an area comparatively free from lupine, but with a good deal of larkspur. On this rather small area they were held all the first day until they were well filled up. After that they began grazing each morning between 3 and 4 o'clock, and did not bed down at night until 8 o'clock or later, so that they were never really empty and hungry. Not one case of poisoning occurred during the season, yet on adjoining range outside there was constant loss from this source.

Since the poisonous plants were about equally abundant inside and outside of the pasture, the difference in loss was attributed to a difference in handling. Without doubt the sheep in the pasture and those on the outside range ate the same species of poisonous plants, but it has been observed that when a sheep is very hungry he will use less power of selection and may eat a whole plant at once, where only tender leaves and choice portions will be nipped off if his hunger has been satisfied and he is free to graze about, selecting his forage. The herded sheep too often remain on the bed ground many hours. In the morning they go out in a band, abreast and hungry. Without selecting, they eat everything that is not positively objectionable to the taste, and they may eat the whole plant—flower, leaves, and stem. Consequently a few of the herded sheep ate the poisonous plants in sufficient quantity to produce more poison than the system of the animal could cast off, and death from poisoning resulted. On the other hand, the pastured sheep ate the same plants, but in smaller quantity, and there were no fatal cases.

WEIGHTS AT CLOSE OF SEASON.

Table 4 gives the weight of lambs from the experimental band and from six other bands that were herded on range near the pasture. The weights were secured in each case by the same method. From twenty to thirty average lambs were selected and weighed, and in each case an additional test was made by taking the average weight of from three to fifteen of the largest lambs and a corresponding number of the smallest ones.



EXPERIMENTAL BAND OF SHEEP AT CLOSE OF SEASON SEPTEMBER 28, 1909.

TABLE 4.—*Weight of lambs at close of season.*

Class of sheep.	Where summered.	Date of weighing.	Age.	Number weighed.	Average weight.
			Days.		*Pounds.*
One-half Shropshire, 930 lambs (J. H. Dobbin).	Coyote-proof pasture.	Sept. 9	150	30 average	[a] 76.0
Do	do	Sept. 28	170	30 average 13 largest, 13 smallest	[a] 76.0 [a] 75.5
One-fourth Merino, three-fourths Rambouillet, 1,215 lambs (J. H. Dobbin).	Herded on range near the coyote-proof pasture.	Sept. 30	170	20 average 6 largest, 6 smallest	[b] 69.5 [b] 69.7
One-fourth Merino, three-fourths Rambouillet, 1,200 lambs (J. Baldwin).	do	Sept. 23	170	20 average 5 largest, 5 smallest	[b] 64.0 [b] 63.2
One-half Merino, one-half Rambouillet, 1,157 lambs (Litch, Hotchkiss & Funk).	do	Sept. 16	150	22 average 4 largest, 4 smallest	[c] 57.0 55.0
One-half Merino, one-half Rambouillet, 1,144 lambs (Litch, Hotchkiss & Funk).	do	Sept. 19	160	21 average 4 largest, 4 smallest	[d] 58.0 60.0
One-half Rambouillet, one-half Shropshire, 1,150 lambs (Litch, Hotchkiss & Funk).	do	Sept. 17	150	18 average 3 largest, 3 smallest	65.0 64.0
Full Merino, 1,490 lambs (Michellod & Robin).	do		150		[e]

[a] Pastured sheep were weighed September 9 and September 28 in early morning after being on the bed ground all night.
[b] Weighed at 6 p. m. after a full day on good feed, perhaps 3 pounds heavier than a morning weight.
[c] Weighed after being off feed for eighteen hours.
[d] Weighed after being off feed for twelve hours.
[e] Not to exceed 60. Final weights not secured. This estimate is a little high, however.

In comparing the weights given in Table 4 it is essential to note that lambs sired by Shropshire rams out of Merino ewes usually outweigh Merino and Rambouillet lambs of the same grade from 5 to 8 pounds, when each band receives the same attention on similar range. Since this is so, it would seem that the Rambouillet lambs of J. H. Dobbin made a growth equal to that made by the pastured lambs. However, the pastured lambs were weighed in the morning after being on the bed ground for twelve hours, while the Rambouillet lambs were weighed in the evening after having grazed on good feed all day. This difference in time of weighing would amount to perhaps 3 pounds. Further, the Rambouillet lambs were mothered by large select ewes. The pastured lambs were mothered by ewes varying from excellent to culls. Some of them were of the small Merino type, and their lambs, even though in excellent flesh during the entire season, weighed only 60 pounds. The variation in the weights of the pasture lambs was very marked. Fifteen lambs selected from the band averaged 95 pounds, 2 of them weighing 100 pounds each. The 13 small lambs in the same condition of flesh averaged only 57 pounds. This variation was due not to a difference in condition of flesh at any time during the season, but to a difference in the grade of the sheep. It is a good example of what might be accomplished by carefully selecting the breeding ewes.

In discussing Table 4 one other point may be emphasized. There was little difference in the breeding or age of the fine-wooled lambs weighed, yet there was considerable variation in the size of the lambs

from the different bands. This variation can be attributed almost wholly to a difference in the herding. The Michellod sheep were of excellent grade and used more acreage of range per head than any other band in the locality, yet the lambs were small. The Dobbin Rambouillet lambs were a little older and perhaps of a little better breeding. Aside from this they were given excellent care and much freedom of action, and in consequence there was no "hospital bunch," and the lambs were within, perhaps, 5 or 6 pounds of what lambs from the same ewes weighed when pastured in 1908. This difference in weight emphasizes the fact that there is as much difference in the results obtained by a first-class herder and those obtained by a poor herder as there is between the results under the pasturage system and those secured by the good herder.

WOOL GROWTH.

The effect of the pasturage system upon wool growth can not be arrived at definitely without a year-long test in pasture. It is well known, however, that in order to secure a fleece of good staple and uniform quality the sheep should be kept in good condition during the entire year. If there is a period of a few months during which the animal is in poor flesh there will be a flaw in the wool. The pasturage system is ideal for producing a fleece long in fiber, uniform in quality, and clean, provided the forage crop is satisfactory. The sheep are free and quiet all the time, they will grow larger, and can be kept in a better and more uniform condition of flesh than when herded.

No accurate test of wool clip was made for the lambs raised in the coyote-proof pasture in 1908; but the owner, Mr. J. H. Dobbin, stated that they sheared at least 1 pound more wool than any other lambs of the same age and breeding that he has ever sheared. Sheep grazed year long in the alfalfa pastures of Salt River Valley, Arizona, shear approximately 3 pounds more wool than the same sheep when handled under the herding system on outside range. In Australia, the home of the pasturage system, it is estimated that the wool clip of the pastured sheep is as much as one-third heavier than was the clip for the same class of sheep when they were handled under the herding system.[a]

There is little question that, as a general rule, the wool growth of pastured sheep would be heavier and cleaner than the growth of sheep handled under customary methods of herding. The increase in amount will perhaps vary from 1 to 3 pounds.

Plate III shows the experimental band at the close of the season, September 28, 1909.

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[a] Special Consular Reports, Australasian Sheep and Wool, 1892.

COST OF HANDLING.

It has already been said that one energetic man can care for four adjoining pastures during the summer grazing season if they are coyote proof. Under such an arrangement he would handle from 8,000 to 10,000 head. It would be necessary to supply him with salt and provisions. To handle the same number of sheep in four bands on the outside range would require four herders and two camp men. On this basis it is safe to say that the cost of handling in pasture would not exceed one-fourth the cost of handling on outside ranges.

No attempt is made to submit actual figures on cost of handling, since it varies for each locality. The comparative statement, it is believed, will apply to any locality.

CARRYING CAPACITY OF THE RANGE.

The effect of the pasturage system upon the carrying capacity of the range was determined by a comparison of the acreage per day used by each pastured sheep with the acreage per day used by each sheep in the four bands that were herded on outside range adjoining the pasture. (Table 5.) The total acreage used by each of the four bands was calculated from a traverse survey made with compass and chain. The number of sheep in each band and the period of grazing were known in each case.

TABLE 5.—*Comparative carrying capacity of pastured and open range.*

Permittee.	Total sheep.	Equivalent in old sheep.[a]	Total time of grazing.	Total acreage.	Total average acres per day for band.	Average acres per day per sheep.	Average acres per sheep for 90 days.	Additional grazing area required by herded sheep over pastured sheep.
								Per ct.
Experimental band	1,110 sheep, 930 lambs.	1,575	June 22–Sept. 29 (99 days).	2,560.0	25.90	0.01644	1.626	.....
Litch, Hotchkiss & Funk.	2 bands (3,065 old sheep, 2,274 lambs).	4,202	June 28–Oct. 1 (94 days).	9,962.4	104.92	.02497	2.472	52
Baldwin.....	1,438 ewes, 1,205 lambs.	2,040	July 2–Oct. 4 (94 days).	5,523.2	58.76	.02880	2.851	75
Michellod & Robin.	1,500 ewes, 1,490 lambs.	2,245	June 28–Oct. 1 (94 days).	6,596.8	70.18	.03125	3.094	[b]90

[a] Two lambs estimated as one ewe.
[b] Canadian-French herder, accustomed to herding range without timber.

The allotment of Litch, Hotchkiss & Funk compares favorably with the pasture in forage crop, water facilities, and topography. At the close of the season it was close grazed, except for a few browse areas in heavy timber. The sheep were cared for by men of less than average ability as herders, and at the close of the season the "hos-

pital cull bunch" was large, and there was a loss of nearly 2 per cent. The lambs were light and the ewes were in only fair condition.

The Baldwin allotment, as a whole, compares favorably with the pasture in carrying capacity. As late fall range it excels the experimental area, but for midsummer it is not so good. The sheep were allowed much freedom, consequently all corners of the range were grazed. They came off in good condition, but the loss was heavy. The range, as a whole, was hardly as close grazed as the pasture area, but showed the effects of trailing and trampling very much more.

The Michellod & Robin allotment was all used, but was not fully utilized. Near the camps it was moderately close grazed, but parts of the allotment were not used until the pine grass had become too coarse and tough for the sheep, which went off at the close of the season in fair condition only. Yet there was forage both in the timber and on the open that the band had merely passed over. The herder was of French descent and spoke very little English. He was afraid of losing sheep in heavy timber, and as a result the sheep were constantly being driven instead of grazing quietly as they should do.

One familiar with the rugged mountain ranges of the West will readily understand that a high degree of accuracy can not be secured in a comparison such as this, where the area involved is 25,000 acres, utilized in five allotments. For two years, however, the work has been done with care and it is believed that the results obtained are just as reliable and perhaps of wider practical application to National Forest grazing lands than results obtained upon small, workable areas would be, since actual conditions of handling could not well be secured on a very small experimental inclosure.

From the data of Table 5 and from other observations it is safe to say that range grazed under the pasturage system will carry from 25 to 50 per cent more sheep than when grazed under the herding system. This conclusion varies slightly from the corresponding conclusion in Forest Service Circular 160. The variation is due not to the test made for carrying capacity, shown in Table 5, but to the belief that an excellent herder can, to a considerable extent, allow his sheep freedom and keep them quiet, thereby increasing the carrying capacity of his range. No doubt there are herders who do this.

SUMMARY.

To summarize the results obtained from observing the actions of sheep under the pasturage system:

1. When left unmolested by herders and dogs in an area protected against destructive animals, a band of ewes and lambs will accommodate themselves to the freedom of such a system and will separate

into small bunches, coming together occasionally but again separating. With few exceptions they will graze openly and quietly. They may travel little or far, but massing, running, and trailing in a compact body are seldom in evidence, and consequently, little damage is done to the forage crop. There is a slight tendency to assemble for the night, but this materially decreases as the lambs become less dependent upon the mother ewes. The tendency to graze about all day and bed where night overtakes them is very prominent.

2. As a result of this protection and freedom, the loss from the pastured band during one hundred days was 0.2 per cent, as against from 1 to 3 per cent from bands herded on range adjoining the pasture. Lambs handled under the pasturage system, between the ages of 2½ months and 6 months, were 9 pounds heavier than the best lambs of any class that had been herded on the adjoining range. The pasturage system will give a heavier, more uniform wool clip, and the cost of handling will not exceed 25 per cent of the cost under the herding system.

3. Further, as a result of protection and freedom, the carrying capacity of the range is from 25 to 50 per cent greater than when grazed under the prevalent methods of herding in large bands on the open range.

REASONS FOR IMPROVED CONDITION OF SHEEP AND INCREASED CARRYING CAPACITY OF THE RANGE.

INCREASE IN WEIGHT.

The pastured area in 1908 and in 1909 was grazed as closely as the outside areas, and the pastured sheep used only two-thirds the acreage of range per head that the herded sheep used. The quality of forage on each was similar. Evidently, then, the additional weight of the pastured sheep was due not to better quality of forage or to greater quantity, but to the quiet, contented attitude of the sheep when free and undisturbed by herders, dogs, and predatory animals. Experiments in fattening sheep for market have demonstrated that it is very essential not to disturb them in any way that will result in fright or worry, if they are to take on flesh rapidly. It has also been demonstrated that regularity in feeding is essential to the best progress. Sufficient water and salt also are important. All these requirements were met in the pasture; they were not met with the herded bands.

The pastured sheep were always grazing at daybreak or a little before, and, as a rule, did not finally bed down until after dark. Until 8 o'clock each morning there was heavy dew on the forage, and consequently they drank little or no water, except during the hot days from July 20 to August 30. They were salted in small bunches, wherever they happened to be, every five days, in amounts sufficient

to satisfy them. Because they were unmolested they became so free from fright that it was possible to ride or walk among the band while grazing without disturbing them.

On the other hand, the sheep under herders were camped at one place for from six days to three weeks, and left the bed at any time from daybreak to 7 o'clock, depending upon the herder and his mood. After the first few days at a camp they were compelled to trail some distance over range with little or no forage. During the day they were rounded up with dogs to such an extent that, naturally, they were expecting disturbance at any time, and therefore were not in an ideal attitude for the best assimilation of the food consumed. Then, while the sun was still shining, they were started back for camp over range already grazed. The amount of disturbance varied with the different herders, and a corresponding variation in the weights of lambs is evident in Table 4.

As a result, the pastured lambs averaged 76 pounds in weight, and the lambs from outside bands averaged from 55 pounds to 67 pounds; the "hospital or drag bunch" in the pasture consisted of one lamb with a broken leg, while the "hospital bunch" in outside bands varied from a few to 200.

INCREASE IN CARRYING CAPACITY.

To account for the increase in carrying capacity of the range under the pasturage system, we must again compare the actions of the sheep in pasture with those of the herded sheep. The difference is no doubt due, first, to the fact that in the pasture every corner of the range was grazed, while on the outside range certain small areas were utilized only in part or not at all; and, second, to the fact that in the pasture the forage was actually consumed, while on the outside range part of it was destroyed by trampling.

In the pasture there was no thicket so dense that the sheep did not penetrate it before the season closed. On outside range there frequently are small areas remote from the camps which the herder can not fully utilize when he has to trail out 2 or 3 miles to reach them. There are areas, too, of browse range in heavy timber which can not be utilized without allowing the sheep some freedom to scatter and penetrate the thickets. Many herders are afraid of losing sheep from the band, and, consequently, either avoid areas where there is danger or else herd the sheep through the thicket rather than allow them to browse about most of the day. Small thickets, for the most part, are utilized, but the interiors of large thickets are barely touched. This, however, is of minor importance as compared with the destruction by trampling.

The destruction of forage by trampling depends upon the action of the sheep on the following points: Open scattered grazing as op-

posed to close bunched grazing; quiet movement as opposed to continuous spreading out and massing on the run, or trailing; moving, well spread out, all day, and bedding where night overtakes them, as opposed to being driven to and from one camp each day for from six to twenty days; and small bunches as opposed to one large band all the time.

It has been shown that, for the most part, the pastured sheep separated into small bunches, grazed openly and quietly, and bedded where night overtook them. The actions of the four bands under herders varied with the methods used by the herders. At best, on ranges where there is more or less heavy timber, the sheep are rounded up occasionally by shouting and whistling, and by dogs. Many herders take pride in having the band so trained that a shrill whistle will bring them together on the run. Such running and massing is extremely injurious to the forage. A herder who understands his work, and is conscientious, will walk around the band and quietly turn the leaders back without disturbing the entire flock. A first-class herder will work all the time, moving around the outside of his sheep, turning the leaders and stragglers in, and seldom using a dog. A poor herder will sit under a tree or near a fire, and at frequent intervals send the dog around the sheep. The result under the former method of management is quiet, scattered grazing, that may approach the pasturage system in efficiency. Under the latter method forage is destroyed and the sheep do poorly. Between the two are all gradations, and the carrying capacity of the same range utilized by different herders may vary at least 25 per cent.

The damage done to the current forage crop by camping for two weeks in one place will depend upon the management of the sheep. If the range is fully grazed from the camp outward, as it usually is, the driving and trailing occurs after the forage crop has been consumed. In such cases the greatest damage comes from the packing of the soil and the actual destruction of the range for some distance around the bedding ground.

If the sheep were grazed quietly and bedded on any suitable area at hand when night came on, the effect of the bedding would be very beneficial to plant growth. Sheep will naturally choose an open, dry, or rocky space for the night, and the effect of moderate bedding, as many as six nights, upon such areas is to fertilize the sterile soil, to which seeds are carried in the wool.

Plate IV shows the stand of vegetation in August, 1909, on an area that had been used as a bedding ground in the coyote-proof pasture during the season of 1908. The amount of forage, made up of bunch grass, pine grass, and annual flowering plants, was at least 100 per cent greater in 1909 than in 1908.

One other feature of the pasturage system that aids in increasing the carrying capacity is the natural tendency of the sheep partly to

graze an area and then pass on to another section, returning a few days, a week, or two weeks later to the range first used. In this way the effect of alternate grazing and resting is, to some extent, secured. The vegetation is not so completely robbed of its leafy foliage as it is when each area is close grazed before the sheep are moved off. In consequence the continued growth is more vigorous, and a greater amount of forage is produced.

SUGGESTIONS FOR HANDLING SHEEP UNDER THE HERDING SYSTEM.

As long as there was an abundance of open range there was little need for economy in the utilization of the forage. But the total acreage of open grazing land is constantly being diminished by settlement, and, as a result, there is a corresponding increase in the demand for grazing privileges. In many sections the urgent demand already far exceeds the supply, and a like condition will soon prevail throughout almost the entire West. It is not only natural, but inevitable, that those who are engaged in the industry should put forth greater effort to secure the best utilization of the range at their disposal.

Based upon the experiments and observations of the past three years, a few simple suggestions are offered for the handling of sheep on the open range under the herding system: First, so far as possible sheep should be allowed natural, quiet freedom; second, they should be kept together by the herder moving continually around the outside of the band, rather than by rounding up with dogs; third, whenever practicable, they should be bedded where night overtakes them; finally, rather than graze a camp to its full capacity at one time, it should be left in good condition and grazed again later.

The success to be attained along these lines will depend upon the ability, conscientiousness, and energy of the shepherd. A man who knows nothing of the habits of sheep can not properly herd them in large bands. A man who is not conscientious will not properly herd them in large bands; and a lazy man should never be allowed to try, if anyone else can be secured. He will wear out his dogs, worry the sheep, and destroy the forage.

It is not assumed that the suggestions given are new to sheepmen, or that they can be followed easily. It is believed, however, that a concentrated effort by sheepmen along these lines will do much toward producing heavier sheep, a better wool crop, and a smaller "hospital bunch," all on less range.

THE PASTURAGE SYSTEM FOR LAMBING EWES.

To determine the feasibility of a pasturage system for lambing ewes, a comparative study of lambing under the methods prevalent on open range and lambing in pastures was made during March, April, and May of 1909.

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VIEW SHOWING EXCELLENT STAND OF GOOD FORAGE ON AN AREA IN 1909 AFTER MODERATE USE AS A SHEEP BEDDING GROUND FOR ONE SEASON, 1908.

The data on lambing under the herding system were secured by general observations on the desert lambing grounds near Phoenix, Ariz., and by a detailed study in lambing camps on the Wallowa National Forest in northeastern Oregon. Lambing in pastures was studied at the private pastures of J. W. Emmons, near Troy, Oreg.

LAMBING ON THE OPEN RANGE.

The details of handling on the open range during the lambing season vary widely for different sections of the West, and usually there is a slight variation even in the same locality. There are, however, two more or less distinct systems under which the methods in general may be classed:

1. The broadcast system, where the sheep are kept on the range without permanent camp or permanent corrals.

2. The corral system, with a permanent camp and permanent corrals where the sheep are held each night.

THE BROADCAST SYSTEM.

On the desert lambing grounds of the Southwest the broadcast system, with slight variations, is followed almost exclusively. No permanent corrals are used, and only occasionally are temporary brush corrals constructed. At the beginning of lambing the ewes are held in bands of from 1,000 to 2,000 head, usually 2,000. The crew employed for each band of 2,000 ewes varies from 5 to 8 men. The band is herded on a comparatively small area during the day, and each ewe that yeans her lamb is quietly left behind as the band drifts away. Before night comes on all the ewes that have dropped lambs during the day are "worked" together and bedded down for the night. The unlambed ewes are bedded near the temporary camp, and one man remains with them during the night. They drift from the bed ground soon after daybreak, leaving behind the ewes that yeaned lambs during the night. Later in the day this night drop is moved on to the range and left in a bunch by themselves. This routine is repeated each day on a different portion of the range until the ewes with lambs are "broadcast" over the range in bunches of from 30 to 80 head. When the lambs first yeaned are four or five days old the night drop and day drop are put together as the nucleus of the lamb band, and to this are gradually added the other small bunches, when the lambs in each are four or five days old. Where coyotes are not troublesome, and where there is room enough to prevent mixing, the small bunches are left undisturbed longer than five days, since both ewes and lambs make more rapid progress in small bunches than when herded in the lamb band. The length of time in a temporary camp depends upon local conditions.

One variation of the broadcast system is to divide the ewe band into bunches of about 500 head before lambing begins, and place perhaps three men with each small bunch to lamb them broadcast, without corrals or sheds. This plan has been followed successfully on the Datil National Forest in New Mexico.

THE CORRAL SYSTEM.

In northeastern Oregon the corral system is used almost exclusively, and there is little variation in the details of handling. A permanent camp is established near running water. One corral large enough to accommodate 1,500 ewes is constructed, usually for permanent use, year after year. From two to five small corrals, varying in size from 20 feet square to 50 feet square, are built adjoining the large corral and opening into it as well as into each other. In addition, most of the camps have a shed, either permanent or temporary, approximately 20 feet wide and 40 feet long. Where lumber is easily procured, the shed on a camp used year after year is roofed with boards, but on the rough break camps a framework of light poles is constructed and covered temporarily with heavy canvas. On the interior of the shed, along each side, small box pens, approximately 4 feet square, large enough for one ewe, are constructed, each with a gate opening upon the center of the shed. Usually a small sheet-iron stove is provided for heating the structure. In addition to the corrals at the main camp, there is at least one large corral on the portion of the range used by the lamb band, and at different places within 1 mile of the main camp there are perhaps five or six small corrals, used as night pens for the various small bunches of ewes with lambs too young to go into the main lamb band. Each corral and pen should be lamb tight and high enough to prevent a ewe from jumping over. Otherwise, a mother may jump out of her pen and leave her lamb uncared for; a young lamb may creep out of a pen and starve; or an unlambed "granny" ewe may jump into a corral and steal a lamb from an indifferent mother. To put this system of corrals and sheds in good running order is the first task of the lambing crew.

To look after the work properly when it is well under way, the following crew of 8 men is necessary: A corral man, who usually is foreman of the crew; a man known as the "drop herder," to herd the band of unlambed ewes; a man termed "drop picker," who works with the "drop herder" on the range, picking up the ewes that yean lambs during the day and caring for them until they reach the corral; a night man to care for the lambs yeaned during the night; two men to herd the small bunches of ewes until the lambs are ready to enter the lamb band; and a man to herd the lamb band.

The "drop herder" takes the unlambed ewes from the corral in the morning, herds them on a comparatively small area all day, and

returns with them to the drop corral at night. At noon he is joined by the "drop picker." Together they are responsible for the welfare of every lamb yeaned on the range until it is turned over to the corral man at camp on the day following.

As the drop band moves toward camp in the evening the ewes that have yeaned lambs during the day fall behind, and are bedded on the range the first night. The "drop picker" works them together on a suitable bedding ground, sees that every lamb has been suckled, and at dark or after, when they bed down permanently for the night, he hangs out one or two lanterns on sticks placed about 50 yards from the sheep. If coyotes are troublesome he will probably hang some article of clothing that has been worn all day on the side opposite the lantern. Coyotes will not approach the lights or the clothing, and, in consequence, the sheep are rarely molested unless they graze away from the lanterns. The "drop picker" returns before they move from the bed in the morning, and works them quietly to camp during the cool morning hours. There they are turned over to the corral boss, and the "drop picker" returns to the range to care for the new "drop."

The unlambed ewes reach the corral at dark, and are turned over to the night man. He is responsible for all loss during the night. The shed must be kept warm, and every lamb that is yeaned should immediately be removed from the corral, along with the mother, and placed in one of the small pens in the shed. A patient, quiet attendant, who understands his work, will move the helpless lamb quietly with his long-handled hook, and coax the mother after it into the pen without any excitement whatever. If a lamb fails to draw milk within a short time after birth, it is aided by the attendant.

The lambs yeaned during the night and those yeaned on the range the preceding day are kept near the camp under the supervision of the corral boss one day. All the ewes with strong lambs are then placed on the range in charge of a shepherd, who looks after from one to three such small bunches. Each small bunch, consisting of the lambs yeaned during twenty-four hours, is kept by itself until the lambs are three days old. Two such bunches are then put together and herded until the lambs are about seven days old. They are then sent to the lamb band. Weak ewes, ewes that do not properly care for their lambs, and ewes with twins are held on range near the corral under the direct supervision of the corral boss during most of the lambing period.

If a lamb is dead when yeaned the mother ewe is given a twin lamb or a motherless lamb. The task of inducing a ewe to adopt a lamb is a study in itself. By the shepherd it is commonly known as "grafting lambs," and the skilled attendant has many devices at his command. The most common method, however, is to remove the

pelt from the dead lamb and fit it on to the lamb to be adopted. The ewe and strange lamb are then placed in a box pen, and, if necessary, kept there for twenty-four hours. Some ewes will adopt a lamb immediately, others need several days of patient supervision. Under the corral system a good crew of men will very rarely turn a ewe out without a lamb if she has milk enough to raise one. In consequence, many lambs are saved that perhaps would not be saved under the broadcast system.

PASTURE LAMBING.

At the private pastures of J. W. Emmons, near Troy, Oreg., 610 ewes were lambed on approximately 325 acres of grazing land, inclosed by a woven-wire fence.[a] The area was subdivided into five small pastures by division rail fences, in order that the ewes with lambs might be kept in small bunches apart from the unlambed ewes. When the lambing began the ewes were divided into three bunches of approximately 200 each, and placed in three separate small pastures, each opening into a fourth larger pasture.

Early each morning all the ewes with lambs old enough to walk were removed from each of the three "drop" pastures. Those with single lambs, able to shift for themselves, were placed in the fourth pasture, and the ewes with twins and those with lambs that were in need of special attention were placed in the fifth inclosure.

After the lambing had been in progress for ten days the three bunches of unlambed ewes were combined into two bunches, and the lambs yeaned during the first ten days were put into the pasture left vacant by joining the ewe bands. At the end of sixteen days the unlambed ewes were all put together, and the second small lamb band was shifted to the vacant pasture. In this way the "drop band" of unlambed ewes was never larger than approximately 300 head, and no bunch of ewes with lambs exceeded 200 head.

Aside from removing the ewes with lambs from the "drop band" each morning, almost no attention was given to the work. A ewe and her lamb were not interfered with unless absolutely necessary. Very little difficulty occurred from ewes failing to own their lambs, even less than under the corral system. It was found that a ewe, especially a young ewe, would remain with her lamb and give it excellent care if unmolested by an attendant or by a "granny" ewe, but when interfered with there was a tendency on the part of the young mother to become indifferent and turn her lamb over to the care of the attendant. Occasionally there was a ewe with teats so large that the most aggressive lamb could not get hold of them. In such cases aid on the part of an attendant is indispensable. If the

[a] For description of fence and inclosure see Forest Service Circular No. 160.

teats are merely distended by an excess of milk the lamb usually can handle them after the udder has once been emptied. If the teats are naturally very large, as they are occasionally, there is little possibility of the ewe raising her lamb. Under any system such ewes should be marked and disposed of before another lambing season.

The entire labor in connection with the pasture lambing usually was performed by one man during the forenoon of each day. It is believed, however, that a little more attention would increase the lamb crop more than sufficiently to justify the additional expense.

Table 6 shows the results obtained under each system. The figures for the broadcast system are approximate estimates based upon the statements of sheepmen. Those for the corral system and for the pasture lambing were computed from actual records kept throughout the lambing season.

The ewes lambed in pasture were for the most part Merino, varying in age from long yearling ewes to ewes 10 years old. There were a few grade Shropshire ewes and a few grade Cotswold ewes. The band observed under the corral system was made up mainly of Merino ewes, varying in age from 5 to 11 years. In this band, too, there were a number of grade Shropshire ewes. The lambs in each case were sired by Shropshire rams.

TABLE 6.—*Comparative data on lambing ewes.*

Number of ewes in each band.	Total number of lambs yeaned.	Number of lambs that died before drawing milk.	Number of lambs that died after drawing milk.	Number of lambs adopted by ewes.	Total loss in per cent before marking.	Total number of lambs marked.	Per cent of lambs marked.	Number of men in attendance.	Cost of labor for lambing 1,000 head of ewes.
BROADCAST SYSTEM IN SOUTHWEST.									
2,000	.....	.....	.....	0	.....	.....	80-100	6-12	$100-$150
CORRAL SYSTEM—NORTHEASTERN OREGON. ELEVATION 2,500 FEET. MARCH 27-APRIL 20.[a]									
1,160	1,167	20 (1.7%)	50 (4½%)	20 (1.7%)	6.0	1,097	95.3	8	$250
4,381	.....	.....	.....	[b]1.7%	[b]6.0	4,022	91.8	(c)	250
PASTURAGE SYSTEM—NORTHEASTERN OREGON. ELEVATION 3,300 FEET. APRIL 15-MAY 15.									
610	607	17 (2.8%)	20 (3½%)	1	6.0	570	93.5	1	$41

[a] The per cent of lambs marked under the corral system in northeastern Oregon varied from 85 per cent to 102 per cent of the total number of ewes. Ninety per cent is considered a good lamb crop.

[b] Approximate.

[c] Eight for each 1,000 ewes.

COMPARATIVE DISCUSSION OF THE SYSTEMS.

LOSS.

The loss under the broadcast system will depend to a great extent upon whether or not coyotes and cats are troublesome. Where small bunches are left on the range without protection, coyotes occasionally kill a good many lambs, but, on the whole, sheepmen who lamb their ewes under this system believe that the loss is very little greater than would occur as the result of driving to and from corrals each day. It is less expensive, and the ewes and lambs will get along on poorer feed than when shut up in a corral for perhaps twelve or fourteen hours each day.

Under the corral system someone was with the lambing ewes during the entire twenty-four hours. In consequence, the number of lambs that died before drawing milk was limited almost wholly to those that were dead when yeaned. A small loss from this source may be expected when the ewes are jammed about in large bands on rough range, immediately preceding the lambing season. At the Emmons pasture the attendant was with the lambing ewes (drop band) only about one hour each day, and at least 1.5 per cent of lambs were lost that could have been saved had some one been in attendance during and immediately after the time of yeaning.

It was found that, under each system, the loss of lambs after they had drawn milk was in great part due to the same causes. In the majority of cases where twin lambs were yeaned, one lamb was larger and stronger than the other. Many of the ewes were contented if one lamb was with them, and the strong lamb would follow the mother all day, taking all the milk, while the weak one, perhaps, would be lying down, slowly starving to death. In such cases special attention must be given the weaker lamb for several days. A few lambs mothered by ewes in very poor flesh, or by ewes that were very sick after yeaning, were lost. A ewe that is barely able to move about is indifferent to her lamb. If turned onto the range before the lamb is thoroughly capable of keeping track of his mother, his chance for life is small.

Under the corral system there was an additional slight loss of good, strong lambs from the small bunches before they reached the lamb band. Occasionally lambs were lost on the range during the day; others were injured in the corrals. This loss, approximately 2 per cent, was avoided in the pasture, a result of the ewes and lambs being kept in small bunches without disturbance either by herders or animals.

Under the corral system, where attendants were present all the time, 1.7 per cent of orphan lambs and twin lambs belonging to ewes that could not raise two lambs were saved by putting them on to ewes that had yeaned dead lambs and ewes that lost their lambs before they left the main corral for the lamb band. Under the pas-

turage system only one lamb was adopted, since the mother ewe usually had left her dead lamb and was off with the drop band before the attendant got around. Under such conditions it would be very difficult to persuade the ewe to adopt a lamb.

Another point of interest was the fact that under the corral system 12 ewes, a little over 1 per cent of the total number, died from the effects of yeaning and from injuries received on the range. In the pasture, 2 ewes died, less than one-third of 1 per cent of the total number.

All losses considered, the final marking per cent under the pasturage system was at least equal to the average marking for bands lambed under the other systems.

CARRYING CAPACITY OF THE RANGE.

At the Emmons pasture 610 ewes were lambed on approximately 325 acres of typical yellow pine range. Under the corral system, or the broadcast system, approximately two sections of range are necessary for the various small bunches, the drop band, and the lamb band throughout the lambing period. Accurate data on comparative carrying capacity of the range under each system were not secured. Lambing in pasture, however, is even less detrimental to the forage crop than grazing the larger bunch in pasture after the lambs are large enough to run about. Ewes with young lambs in pasture remain well spread out and move about very little. On the other hand, lambing under the corral system is more detrimental to the forage crop than herding on the open range in summer, since the sheep are camped at one place during the lambing period of one month, and are all driven to and from corrals each day, while the drop band is comparatively close herded to facilitate the handling of lambs yeaned on the range, and the small bunches of ewes with lambs must be rounded up a number of times each day to enable the lambs to suck. The broadcast is less injurious than the corral system to both range and sheep, for during the greater part of the lambing period herding is confined largely to the unlambed ewes, while the ewes with lambs remain quiet, in small bunches. On the other hand, it is safe to say that, where lambing ewes are handled under the pasturage system as described the carrying capacity of the range will be from 30 to 50 per cent greater than under the corral system.

COST OF HANDLING.

Results as good as those secured under the two other systems were secured under the pasturage system at a cost not exceeding 16 per cent of the cost of handling under the corral system, and perhaps 33 per cent of the average cost of handling under the broadcast system. No itemized statement of cost is given, since none would apply to all conditions. It is believed that the comparative statements given will be applicable in any locality.

POSSIBLE USE OF INCLOSURES IN CONNECTION WITH LAMBING ALLOTMENTS.

The great variation in ruggedness, carrying capacity, remoteness from shipping points, weather conditions, and trouble from predatory animals between the ranges used for lambing ewes makes impracticable a definite statement of the extent to which the pasturage system is applicable in connection with lambing grounds. From the observations made and the data secured, however, it is believed that inclosures in one form or another can profitably be constructed in connection with most lambing camps.

In the customary range band of ewes lambed on the open range there are usually, if not always, a few ewes that will not properly care for their lambs; weakling lambs that should have special care; weak ewes that require quiet and good feed in order to gain strength; ewes with twin lambs in need of special care; and ewes with teats so large that the young lamb can not handle them. If these doubtful cases could be kept in an inclosure and given special attention until they are able to shift for themselves it would mean the saving of from 2 to 5 per cent of lambs that ordinarily die before the end of the lambing season. An inclosure sufficient to meet this need would be small and a profitable investment even on remote ranges. In many localities it would not be necessary to have a coyote-proof fence.

Another arrangement would be to have an inclosure for the doubtful cases as described above, and, in addition, a series of small inclosures in which the ewes with lambs could be left unmolested in small bunches until the lambs are four or five days old. This arrangement would do away with the labor of at least two men, necessary under the corral system, while the lambs would make more rapid progress and there would be less loss.

Where an individual has title to lambing range of moderate or high carrying capacity, readily accessible from a shipping point, the increase in carrying capacity and decrease in expense of handling in pasture during the lambing season will justify the cost of construction necessary to inclose the entire allotment.[a]

Experiments to determine the economic value of such inclosures in connection with lambing allotments will be inaugurated during the coming season, 1910. It is hoped that information of value to sheep men can be published at the close of the season.

Approved:

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *March 10, 1910.*

[a] For specifications of a coyote-proof fence, see revised specifications offered in Forest Service Circular No. 160.

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